WHAT IS CLAIMED IS:

1. An isolated nucleic acid encoding a polypeptide comprising an alpha subunit of a KCNQ potassium channel, the polypeptide:

(i) forming, with at least one additional KCNQ alpha subunit, a KCNQ potassium channel having the characteristic of voltage-gating; and

(ii) comprising a subsequence having at least 65% amino acid sequence identity to amino acids 343 to 640 of SEQ ID NO:4.

2. The nucleic acid of claim 1, wherein the polypeptide specifically binds to antibodies generated against SEQ ID NO:4 or SEQ ID NO:5.

3. The nucleic acid of claim 1, wherein the polypeptide encodes human KCNQ5.

4. The nucleic acid of claim 1, wherein the nucleic acid encodes an amino acid sequence of SEQ ID NO:4 or SEQ ID NO:5.

5. The nucleic acid of claim 1, wherein the nucleic acid comprises a nucleotide sequence of SEQ ID NO:1, SEQ ID NO:2, or SEQ ID NO:3.

6. The nucleic acid of claim 1, wherein the nucleic acid is amplified by primers that selectively hybridize under stringent hybridization conditions to the same sequence as the primers selected from the group consisting of:

CCACGTCTGCACTCAGGAAGTCTCCG (SEQ ID NO:6)

CCAGCTTGGATTCTATGGACTGTACC (SEQ ID NO:7)

GAAGAGCCGAGAGAAAATAACAGCAG (SEQ ID NO:8)

GCCCTGTGGATAGCAAAGATCTTTCG (SEQ ID NO:9)

GCTGTGAGCATAAACCACTGAACCC (SEQ ID NO:10)

CCATGCGCACCATGCGGAGGATCTG (SEQ ID NO:11)

CATGAAGGATGTGGAGTCGGG (SEQ ID NO:12) and

TGGCTAAAGAACTGCTATGCCTGG (SEQ ID NO:13).

7. The nucleic acid of claim 1, wherein the polypeptide encoded by the nucleic acid comprises an alpha subunit of a homomeric potassium channel.

8. The nucleic acid of claim 1, wherein the polypeptide encoded by the nucleic acid comprises an alpha subunit of a heteromeric potassium channel.

9. The nucleic acid of claim 1, wherein the nucleic acid selectively hybridizes under moderately stringent hybridization conditions to a nucleotide sequence of SEQ ID NO:1, SEQ ID NO:2, or SEQ ID NO:3.

10. An isolated nucleic acid encoding a KCNQ polypeptide, the nucleic acid specifically hybridizing under stringent conditions to a nucleotide sequence of SEQ ID NO:1, SEQ ID NO:2, or SEQ ID NO:3.

11. An isolated nucleic acid that specifically hybridizes under stringent conditions to a nucleic acid encoding an amino acid sequence of SEQ ID NO:4 or SEQ ID NO:5.

12. A method of detecting a nucleic acid, the method comprising contacting the nucleic acid with an isolated nucleic acid of claim 1.

13. An isolated polypeptide comprising an alpha subunit of a KCNQ potassium channel, the polypeptide:

(i) forming, with at least one additional KCNQ alpha subunit, a KCNQ potassium channel having the characteristic of voltage-gating; and

(ii) comprising a subsequence having at least 65% amino acid sequence identity to amino acids 343 to 640 of SEQ ID NO:4.

14. The polypeptide of claim 13, wherein the polypeptide specifically binds to antibodies generated against SEQ ID NO:4 or SEQ ID NO:5.

15. The polypeptide of claim 13, wherein the polypeptide has a molecular weight of between about 95 kD to about 104 kD.

16. The polypeptide of claim 13, wherein the polypeptide has an amino acid sequence of human KCNQ5.

17. The polypeptide of claim 13, wherein the polypeptide has an amino acid sequence of SEQ ID NO:4 or SEQ ID NO:5.

18. The polypeptide of claim 13, wherein the polypeptide comprises an alpha subunit of a homomeric potassium channel.

19. The polypeptide of claim 13, wherein the polypeptide encoded by the nucleic acid comprises an alpha subunit of a heteromeric potassium channel.

20. An antibody that specifically binds to the KCNQ polypeptide of claim 13.

21. The antibody of claim 20, wherein the polypeptide to which the antibody binds has an amino acid sequence of SEQ ID NO:4 or SEQ ID NO:5.

22. An expression vector comprising the nucleic acid of claim 1.

23. A host cell transfected with the vector of clam 22.

24. A method for identifying a compound that increases or decreases ion flux through a potassium channel, the method comprising the steps of:

(i) contacting the compound with a KCNQ polypeptide, the polypeptide

(a) forming, with at least one additional KCNQ alpha subunit, a KCNQ potassium channel having the characteristic of voltage-gating; and

(b) comprising a subsequence having at least 65% amino acid sequence identity to amino acids 343 to 640 of SEQ ID NO:4; and

(ii) determining the functional effect of the compound upon the potassium channel.

25. The method of clam 24, wherein the functional effect is a physical effect.

26. The method of clam 24, wherein the functional effect is a chemical effect.

27. The method of clam 24, wherein the polypeptide is expressed in a eukaryotic host cell or cell membrane.

28. The method of claim 27, wherein the functional effect is determined by measuring ion flux, changes in ion concentrations, changes in current or changes in voltage.

29. The method of clam 24, wherein the functional effect is determined by measuring ligand binding to the channel.

30. The method of clam 24, wherein the polypeptide is recombinant.

31. The method of clam 24, wherein the potassium channel is homomeric.

32. The method of clam 24, wherein the potassium channel is heteromeric.

33. The method of clam 24, wherein the polypeptide is human KCNQ5

34. The method of clam 24, wherein the polypeptide has an amino acid sequence of SEQ ID NO:4 or SEQ ID NO:5.

35. A method of modulating ion flux through a KCNQ potassium channel, the method comprising the step of contacting the KCNQ potassium channel, wherein the channel comprises a KCNQ5 alpha subunit, with an therapeutically effective amount of a compound identified using the method of clam 24.

36. A method for identifying a compound that increases or decreases ion flux through a potassium channel comprising a KCNQ5 polypeptide, the method comprising the steps of:

(i) entering into a computer system an amino acid sequence of at least 50 amino acids of a KCNQ5 polypeptide or at least 150 nucleotides of a nucleic acid encoding the KCNQ5 polypeptide, the KCNQ5 polypeptide comprising a subsequence having at least 65% amino acid sequence identity to amino acids 343 to 640 of SEQ ID NO:4;

(ii) generating a three-dimensional structure of the polypeptide encoded by the amino acid sequence;

(iii) generating a three-dimensional structure of the potassium channel comprising the KCNQ5 polypeptide;

(iv) generating a three-dimensional structure of the compound; and

(v) comparing the three-dimensional structures of the polypeptide and the compound to determine whether or not the compound binds to the polypeptide.

37. A method of detecting the presence of hKCNQ5 in human tissue, the method comprising the steps of:

(i) isolating a biological sample;

(ii) contacting the biological sample with an hKCNQ5-specific reagent that selectively associates with hKCNQ5; and,

(iii) detecting the level of hKCNQ5-specific reagent that selectively associates with the sample.

38. The method of claim 37, wherein the hKCNQ5-specific reagent is selected from the group consisting of: hKCNQ5-specific antibodies, hKCNQ5-specific oligonucleotide primers, and hKCNQ5-nucleic acid probes.

39. In a computer system, a method of screening for mutations of a human KCNQ5 gene, the method comprising the steps of:

(i) entering into the computer a first nucleic acid sequence encoding a KCNQ5 polypeptide having a nucleotide sequence of SEQ ID NO:1, SEQ ID NO:2, or SEQ ID NO:3, and conservatively modified versions thereof;

(ii) comparing the first nucleic acid sequence with a second nucleic acid sequence having substantial identity to the first nucleic acid sequence; and

(iii) identifying nucleotide differences between the first and second nucleic acid sequences.

40. The method of claim 39, wherein the second nucleic acid sequence is associated with a disease state.

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